

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF OHIO
WESTERN DIVISION

Susie Leahy, individually and as	:	Case No. 1:10-cv-070
Guardian ad litem, et al,	:	
	:	
Plaintiffs,	:	
	:	
vs.	:	
	:	
Signature Engines, Inc., et al,	:	
	:	
Defendants.	:	

ORDER

Plaintiff Susie Leahy, for herself and as guardian ad litem of her minor children, brought this wrongful death action against Signature Engines, Inc. ("Signature"), O&N Aircraft Modifications, Inc., Avionics, Inc., and unidentified Does. Her deceased husband, William Leahy, perished in the crash of a Piper Navajo Chieftain airplane he was piloting shortly after taking off from the North Las Vegas Airport on August 28, 2008. All of the named defendants had performed work or provided parts and materials for the plane's engines a few months before the crash.

Plaintiffs have dismissed their claims against O&N (Doc. 36) and Avionics (Doc. 37), leaving Signature as the sole defendant. Signature overhauled the airplane's engines approximately five months before the crash. Plaintiffs generally allege that Signature was negligent in performing that work and specifically failed to detect a breach in an engine exhaust pipe, which

Plaintiffs allege caused or contributed to the crash and Leahy's death.

Plaintiffs have filed a motion in limine seeking to exclude the testimony of Signature's expert, Roch J. Shipley. (Doc. 54) Signature has filed a motion seeking to exclude Plaintiffs' experts Douglas Stimpson, Manuel Raefsky, and Harry Hasegawa. (Doc. 53) Both motions argue that the experts' opinions are inadmissible under Fed. R. Evid. 702 and the principles articulated in Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579 (1993) and its progeny.

FACTUAL BACKGROUND

The two-engine Piper Chieftain airplane involved in this case was owned by a California resident, Ken Park, who had reached an agreement to sell the plane to a Korean company. The airplane apparently required some servicing and modifications for a flight to Korea, and Park hired Signature in Cincinnati, Ohio to overhaul both of the plane's engines. The plane was flown to Cincinnati sometime in March 2008. Signature removed both engines and reinstalled them on or about April 3, 2008. Avionics (the dismissed defendant) installed two long range "nacelle" fuel tanks in each engine compartment behind a firewall, and performed an annual inspection of the plane in Cincinnati on June 25, 2008. The owner hired pilot Fred Sorenson to fly the plane from Cincinnati to the North Las Vegas Airport in Nevada in late June,

where Sorenson intended to make final modifications and obtain the necessary permits to fly the plane to Korea.

Sorenson encountered some problems with the airplane en route from Cincinnati to North Las Vegas (described as a failed left vacuum pump, leakage in the air conditioning system, an engine idle problem, and a leak in an "inboard door actuator"). A Nevada company, Lone Mountain Aviation, worked on the plane to address these issues and performed other maintenance work, including an oil change. Lone Mountain issued an Export Certificate of Airworthiness for the plane on August 14, 2008.¹ On August 10, Sorenson noted in the airplane's log book that he completed an inspection in accordance with the airplane manufacturer's checklist.

At some point in August, Sorenson also installed four long-range "ferry" fuel tanks in the airplane. This work required Sorenson to install new fuel lines for these additional tanks. This additional fuel system required FAA approval before the plane could be flown, but Sorenson encountered some difficulty obtaining that approval from the local FAA office. The plane's owner then hired another pilot, Mr. Leahy, to fly the plane to Palo Alto, California, where Leahy planned to obtain the

¹ Plaintiffs also filed a lawsuit in the Nevada district court against Lone Mountain Aviation, Inc., and sought a transfer order under 28 U.S.C. §1407. The MDL Panel denied that request, but the parties have apparently tried to coordinate discovery in both cases.

necessary FAA permits and then fly the plane to Korea. Sorenson sought a temporary FAA permit to allow the plane to be flown to Palo Alto with the ferry fuel tank system installed, but this was denied. Sorenson was instructed to disconnect the ferry tank fuel system and reconnect the original fuel lines prior to the flight to Palo Alto. (Plaintiffs' expert Stimpson concedes that there is no documentation verifying that either Sorenson or Leahy removed the ferry fuel lines or reinstalled the original Piper fuel lines.)

Leahy arrived in Las Vegas on August 28, and went with Sorenson to the airplane. According to Sorenson's statement, he and Leahy were together while Leahy "pre-flighted the airplane." There is documentation that Leahy bought 132 gallons of fuel that day, and he departed the airport at 2:23 p.m. Eight minutes later, Leahy reported an emergency and told the air controller that he needed to return to the airport. One minute later he reported "engine failure rough engine." Approximately two minutes later, the plane clipped some power lines and crashed into a house about one and a half miles short of the airport's runway. Leahy died in the crash, and the plane was largely destroyed in the resulting fire.

The NTSB investigated the crash. According to the NTSB's factual report (Doc. 62, Ex. F), a "tee" fitting was found in the wreckage, which Sorenson identified as part of the ferry fuel

tank lines. The NTSB noted that the fractured surfaces of the components "visually matched each other, which was consistent with the tee fitting having been connected to the airplane's fuel system at the time of the accident." (Id. at pg. 1g) A piece of another fuel line was also found at the scene, which Sorenson believed was a piece of the original fuel line. According to the NTSB factual report, Sorenson said that the original line should have been connected to the plane's fuel system rather than the "tee" fitting. The NTSB and a representative from Hartzell, the propeller manufacturer, examined the propeller assemblies and found evidence that "little or no rotational energy" was present in the right propeller at the time of impact, as the blades "appeared to have been feathered." Hartzell's representative reported that at impact (based on his observations of the assembly), the left engine was apparently producing its maximum rated horsepower. (Id.)

Several witnesses reported to NTSB that they had seen the plane coming down. One saw the right side engine putting out black smoke; a second witness saw puffs of smoke and then a continuous stream of white smoke from the right engine. He then saw flames beneath the right engine. A third witness saw the plane south of his position, and saw a continuous stream of white smoke from the right engine as it descended along with fire and flames. He reported seeing two or three quick puffs of smoke

from the left engine, but did not see any fire. Another witness who was in a car close to the crash site saw the plane coming down, and reported seeing smoke and flames coming from its right side.

During later inspections of the wreckage, the experts documented an area of cracks, fractures and holes near an elbow in the left engine's exhaust pipe. The right engine exhaust pipe did not display any similar damage.

The Challenged Experts' Opinions

Plaintiffs' expert Douglas Stimpson concluded that the holes and the breach observed in the left engine exhaust pipe would have taken some time to form, "and most likely would have been present during the engine change that was performed by Signature Engines on April 3, 2008." (Stimpson also believes that damage would have been present during Avionics inspection in June, Sorenson's inspection in August, and when Lone Mountain performed its work and issued an airworthiness certificate.) Stimpson opined that the plane took off the day of the accident with a defective left engine exhaust pipe, and that the holes and cracks

... allowed the hot exhaust gas to be directed into the engine nacelle area in the area of the engine firewall instead of being routed overboard. This would have allowed extreme heat to build up in the area of the engine and firewall area. The area behind the left engine firewall contained the [nacelle] fuel tank that was installed by Avionics Inc. on June 27, 2008. ... The fire most likely started in the left

engine/nacelle area due to the breach in the turbo exhaust pipe that allowed superheated exhaust gas to ignite the flammable fluids that are located in that area. The examination of the left side of the aircraft revealed that it had substantially more fire damage than the right side and that the fire most likely started in that area.

(Doc. 62, Ex. D, Stimpson report at 7-8)

Plaintiffs also retained Harry Hasegawa, a fire sciences consultant, who worked with Stimpson. Hasegawa's report notes that most of the plane was destroyed by the crash and resulting fire. But he observed that "Generally, the whole left side of [the] aircraft had been destroyed. Although most of the right side was destroyed, more of it remained than the left side. The remaining parts suffered various degrees of damage caused by the crash impact and/or the post crash fire." (Doc. 53, Ex. L at 5) Hasegawa acknowledged the eyewitnesses' reports of fire and smoke in the area of the right engine, but stated that his analysis indicated that the left engine experienced problems, and that the witnesses on the ground may have been confused due to their orientation vis-a-vis the position of the plane as it was coming down.

Because the fire developed so quickly after takeoff, Hasegawa opined that the fire was ignited by flammable liquids such as oil or gas. He then concluded that "the fracture and breach in the left engine turbo exhaust [pipe] would provide a viable ignition source for an engine fire. Leaking turbo exhaust

gases typically reach temperatures of approximately 1600°F." (Id. at 7.) He noted that Sorenson and Leahy had both reported engine problems, and that one eyewitness reported hearing an engine sputtering before the crash. "All of these facts are consistent with a malfunction and subsequent fire in the left engine." (Id.)

Plaintiffs' third expert, Manuel Raefsky, is a consulting engineer providing technical services concerning materials selection, materials processing, materials inspection, process control, and failure analysis. Following an agreed protocol in the fall of 2011, Raefsky and others removed four samples from the left exhaust pipe, and three from the right. Two of the left-side specimens included portions of the area that Stimpson and Hasegawa pointed to as a cause of a left engine fire. The samples were then examined and tested, including scanning electron microscopy fractography and metallographic exams.

Based on these examinations and the circumstances of the accident, Raefsky opined that the "breach and associated cracking observed in the left engine exhaust overboard pipe ... was the result of a long term erosion process that locally thinned the wall thickness to the point where it could no longer contain the internal operating pressure." The long-term erosion of the stainless steel pipe "thinned and pitted the base metal to the point where it 'blew out.'" Raefsky believes that the erosion

process culminating in the breach in the pipe occurred over a significant period of time, much longer than the 26 hours of flight operation the plane experienced between the time that Signature overhauled the engines and the date of the crash. He concluded: "Had the pipe been removed at the time of overhaul, any fire resulting from ignition by the hot [exhaust] gases would have been prevented." (Doc. 53, Ex. G, Raefsky Report at 5)

Signature retained Roch Shipley, a consultant/investigator who specializes in "... design, manufacture, materials, and operational factors, including independent failure analyses. Specializes in complex issues involving multiple disciplines and/or accident reconstruction. ... Work includes evaluation of components from aircraft, automobiles, trucks, railroad, industrial equipment, fire-damaged artifacts, electrical and gas appliances, and utility equipment." (Doc. 62, Ex. A) Shipley believes that the physical evidence does not support Stimpson's opinion that the left engine exhaust pipe developed a hole due to long-term erosion that was present when Signature Engines overhauled the engines in March-April 2008. Shipley believes that the holes, breeches and cracks observed on the pipe were caused during the accident or from handling of the wreckage after the accident. Based on photographs and his visual inspection, he opines that external pressure on the pipe pushed material toward the inside, and that the holes were not formed while the engines

were in operation. Shipley also opines that even if a small hole (1/2 inch diameter) was present in the exhaust pipe prior to the crash, the volume of exhaust gases leaking through that hole would not be sufficient to ignite a fire in the scenario hypothesized by Stimpson and Hasegawa.

Given the evidence suggesting a problem with the right engine and the eyewitness reports of fire on the right, Shipley concludes that a "much simpler explanation, supported by the evidence, can be found in the fact that the subject flight was the first flight after the installation of the un-airworthy, not FAA approved, uncompleted, and left-in-service aircraft temporary ferry fuel system. Specifically, it is more likely than not that a malfunction/leak in this system led to the failure of the right engine." (Id. at 20)

ANALYSIS

Fed. R. Evid. 702 permits an expert witness who is qualified to do so, to offer an opinion when the Court finds:

(a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert has reliably applied the principles and methods to the facts of the case.

The Supreme Court held that the Rule 702 gate-keeping inquiry is "a flexible one," and the Court's focus ... must be solely on

principles and methodology, not on the conclusions they generate." Daubert v. Merrell Dow, 509 U.S. at 594-95.

Although there is no definitive checklist of factors that must be satisfied, relevant factors include whether the theory or technique employed by an expert has or can be tested, whether it has a known error rate, and whether it is generally accepted in the relevant scientific or technical community. Id. at 593-94. The inquiry is "context-specific, and must be tied to the facts of a particular case." Surles ex rel. Johnson v. Greyhound Lines, Inc., 474 F.3d 288, 295 (6th Cir. 2007). In this case, involving several disciplines relevant to accident investigation and reconstruction, the expert's personal knowledge and past experience in those disciplines are important factors to be considered, and somewhat less emphasis placed on whether a basic scientific theory has been subjected to peer review or rigorous testing.

The Supreme Court has also cautioned that "[t]he court may not exclude an expert's opinion because it disagrees with his conclusions. Nevertheless, conclusions and methodology are not entirely distinct from one another. Trained experts commonly extrapolate from existing data. But nothing in either Daubert or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the ipse dixit of the expert. A court may conclude that there is

simply too great an analytical gap between the data and the opinion proffered." General Electric v. Joiner, 522 U.S. 136, 146 (1997).

Plaintiff's Experts

1. Manuel Raefsky

Raefsky has a bachelor's degree in metallurgical engineering and post-graduate studies in materials sciences and fracture mechanics. He spent almost forty years in various industrial and engineering positions, including with the Air Materials Laboratory of the United States Navy, and ten years with a Boeing Company division doing materials quality control and failure analysis. He worked for approximately 20 years as a private consulting engineer, which included aviation work.

Raefsky's report describes his observations of the exhaust pipes and turbochargers at Dr. Shipley's facilities in Sugar Grove, Illinois, and metallurgical examinations at a facility in Melrose Park, Illinois. Raefsky observed that the exhaust pipe in the area of the cracks and holes was thinner than the pipe upstream or downstream of that area. The inside of the left pipe had a build up of loose and flaking material, much less than was seen on the right pipe. Four samples were then removed from the left pipe (see Photograph 9 attached to his report for their locations) and three from the right (Photograph 10) for further testing. Measurements of the thickness of the stainless steel

exhaust pipe showed thickness of .052 inches at a point away from the damaged area and closer to the turbocharger. The pipe thickness at the area of the cracks and holes was less than .003 inches of steel, which (according to Raefsky's report) is only five to six percent of sound metal. SEM exams on the oxide layer on sample #1 (closest to the inlet) showed continuous oxide with occasional cracks. The oxide layer at sample #2, the cracked area, displayed cracking in the oxide layer.

Raefsky states that the thinning of the pipe to less than .003 inches was due to a long term erosion process, during which the steel pipe oxidized from the high velocity hot exhaust gas discharged from the engine's turbocharger. As the oxide layer formed and cracked under normal operation, Raefsky explained that fresh metal would be exposed, resulting in further oxidization and flaking. Eventually, Raefsky concluded, the pipe's steel became so thin that it 'blew out' while the engine was in operation. Raefsky believes that the condition observed on the exhaust pipe was not due to ground impact or the resulting fire, but acknowledged that adjacent areas on the left exhaust pipe exhibit damage caused by an external force. Raefsky believes that a hole or breach was present in the pipe when Signature overhauled the engines, as it could not have developed over the relatively short time (approximately 26 flight hours) that elapsed before the crash. (Raefsky Report at 6)

Raefsky confirmed in his deposition that he will not offer an opinion on whether there actually was a fire in the engine. He also confirmed that he was not retained to specifically determine when the hole appeared in the pipe. He was asked his opinion on that issue, however, and he testified that it was approximately 50 to 100 flight hours before the crash. (Raefsky Dep. at 42) He cited his experience with steel turbines used in the nuclear and fossil fuel business, which over time will corrode or erode at elbows or bends in the pipes. Failures occur in these areas more often because the elbow or bend alters the direction of the gas or steam flowing through the pipe. He believes that the situation presented by the elbow in the exhaust pipe is no different from his experience with turbines. He also cited an FAA notice about engine fires caused by cracked flange clamps at the engine turbocharger. He testified that if a cracked flange clamp could cause a fire due to leaking exhaust gases, the same principles suggest that a fire could be caused by a hole eroded in the pipe. (Raefsky Dep. at 72-74)

Signature does not directly challenge Raefsky's qualifications, and does not challenge his metallurgical tests or his opinions that long-term erosion caused thinness in the pipe wall. Signature contends that Raefsky should not be permitted to testify about internal operating pressure in the exhaust pipe, because he did not know what that pressure was and did not

perform any tests to determine it. Raefsky was asked at his deposition if he could calculate that pressure, and he began to make that calculation using a standard formula concerning materials mechanics. But he also testified that in his opinion the greatly reduced wall thickness is the reason the pipe failed at that point, and "whatever the design pressure [of the pipe] is, whatever pressure you want to talk about, upstream, downstream, that three-thousandths of an inch could not contain the pressure. That's why it blew out." (Raefsky Dep. at 31)

Signature and its experts disagree with Raefsky's conclusion. But as noted above, the Court's gate-keeping function is to determine if a qualified expert's opinion is premised upon a reliable application of principles or methods to the available facts. Raefsky is qualified to offer an opinion on the condition of the exhaust pipe he observed, and what caused its appearance. The lack of testing to calculate internal pipe pressures does not warrant exclusion of his opinion, as he explained why he believes such testing is not necessary.

Signature's arguments go to the weight that the trier of fact may give to Raefsky's opinions, and are not a basis to exclude them.

2. Douglas Stimpson.

Stimpson has been an aviation safety investigator for over 25 years, and has participated in many crash investigations. He is a licensed pilot with thousands of hours of flight time, and a

certified airframe mechanic. He also worked as an engineer for Piper Aircraft during the time it manufactured the Piper Navajo airplane. His supplemental declaration (Doc. 61, Ex. 1 at 2) states that he personally participated in testing over many years on the type of airplane and engine involved in this case. He has tested the type of firewall installed in this model airplane; he states that temperatures in the area of the turbo exhaust pipes can be very high, which is why the FAA requires the firewall to be tested to 2,000°F. Stimpson's supplemental declaration states that he has worked with both Piper and with Lycoming (the engine manufacturer) as a consultant, and has investigated many accidents in which hot exhaust gases ignited a fuel source in an engine compartment.

Signature contends that Stimpson's opinion that a left engine fire was ignited when hot gases escaped from an erosion-caused hole in the exhaust pipe is unreliable. Stimpson admits that any physical evidence of a pre-crash engine fire was destroyed in the crash. Because of this admission, Signature argues that his opinions are premised on a series of invalid assumptions, specifically:

- (1) Leahy topped off the engine oil prior to take off. Signature argues there is no documented evidence that he did so.
- (2) The flow rate of the oil from the breather tube. Stimpson did not do any tests to determine how much oil would be

"blown out" of the tube if Leahy had filled the engine with oil.

(3) The precise combustible mix of fuel and air present in the engine compartment. Stimpson has not done any test to confirm his opinion that there was a sufficient mix to ignite the oil.

(4) Other sources of fuel for the fire. Stimpson does not have an opinion on another source, but testified that a second possible source was engine hoses in the vicinity of the exhaust pipe. But Stimpson did not know the ignition temperature of the hoses. Signature also argues that the hoses are too far away from that area of the exhaust pipe to permit ignition.

(5) The internal pressure in the exhaust pipe. Stimpson testified that he does not know what that pressure may have been.

Stimpson addressed most of these issues. He believes that any experienced pilot would "top off" engine oil before a flight. He testified: "[t]here's a good chance that Mr. Leahy either filled up or put oil in it in his preflight, and that that activated that breather, and that was the source of why this flight - why the fire occurred on this flight, and not necessarily on the flight before." (Stimpson Dep. at 32)

Stimpson did not test how much oil would have blown out on Leahy's flight because he believes there was no practical way he could test this issue. Each engine operates differently in terms of normal or optimum oil usage, and he said the left engine in

the same plane could "blow out" more oil than the right engine, or vice versa. Stimpson relies on the apparent function of the oil breather tube in assuming that oil was moving through and exiting from that tube during Leahy's flight. He did not test the specific mix of oil and air that may have been present that day, but knows from his own experience that oil emitting from the tube does so in a mist form. While he could not state the precise ignition temperature of the engine hoses, he knows that they are flammable when subjected to excessive heat, which he believes was escaping from the eroded exhaust pipe. The Court finds that all of these assumptions are based upon Stimpson's own experience as a pilot, and his knowledge of this type of aircraft and engine. These assumptions are not merely speculation based on nothing but Stimpson's own ipse dixit.

Signature contends that Stimpson is not a "fire expert" and cannot testify about the cause of an onboard fire. Stimpson's knowledge and experience is aviation investigation, not fire science, as he readily admitted. But the Court finds that his opinions are based on his knowledge of and experience with aircraft engine failures and fires. Signature seeks to preclude Stimpson from testifying about other aircraft cases that involved leaking oil filter gaskets. Signature says these other cases are not relevant or reliable, but it does not specifically explain why. Assuming that a proper factual foundation is made at trial,

Stimpson is entitled to rely upon his experience in cases involving similar engines from the same manufacturer.

And finally, Signature argues that Stimpson's opinion that the exhaust pipe was eroded to the point of failure when Signature overhauled the engines is sheer speculation and should be excluded. Stimpson testified that he does not know how big any hole in the exhaust pipe in early April 2008 might have been, or how visible it may have been when Signature reinstalled the engines. But based on his experience, he testified that he could differentiate "with positive assurance" post-accident damage to the pipe and pre-accident erosion and thinning damage. He relies upon the metallurgical findings of the eroded area and the thickness of the steel at the edges of the breach, to conclude that the condition was not caused by external forces but by long-term erosion that Signature should have detected. (Stimpson Dep. at 23-24)

Stimpson's basic opinion is that superheated exhaust gases escaped from the pipe into the engine compartment and caused a fire. He bases this theory upon his knowledge and experience in aircraft investigations, and he relies on the other experts' findings to support his theory. This theory and the assumptions supporting it are not so novel that specific scientific testing would be required to validate his assumptions or hypothesis. That was the case, for instance, in Truck Ins. Exchange v.

Magnetek, Inc., 360 F.3d 1206 (10th Cir. 2004), where the district court excluded an expert's opinion that the long-term exposure of wood to temperatures below wood's ignition point could result in pyrolysis, the formation of carbon deposits that could ignite when exposed to a ballast in a fluorescent light fixture. The publications that the expert relied on to opine that the fire at issue started in this manner specifically noted the authors' expression of great caution about the reliability of the theory to explain the cause of a real-world fire. Since the pyrolysis theory was untested and somewhat novel, the lack of testing under real-world conditions rendered the theory unreliable as applied to the facts of that case. Here, Stimpson's inability to state the precise flow rate of oil emitting from the breather tube, or the ignition temperature of an engine hose, or the internal pressure on the exhaust pipe while the engine is operating, does not require the exclusion of his testimony. All of Signature's arguments are undoubtedly interesting fodder for a vigorous cross-examination at trial.

3. Harry Hasegawa

Hasegawa is an engineer who has specialized in fire research since he obtained his Master's Degree in 1975. He worked as a Fire Research Engineer from 1978 to 1993 at the Lawrence Livermore National Laboratory, and participated in the design and performance of full-scale fire tests as well as research on other

issues relating to fire safety. He has worked as an independent fire consultant investigating fires involving aircraft, and involving both residential and commercial buildings. He states that he has extensive experience inspecting and reviewing fire-damaged aircraft to determine the cause and origin of onboard fires. Hasegawa shares Stimpson's opinion that a left engine fire was caused by ignition of flammable fluids and/or combustibles.

Signature does not directly challenge his qualifications, but contends his testimony should be excluded in its entirety because he failed to follow accepted methodology for the investigation and analysis of fires and explosions set forth in NFPA 921, an authoritative publication of the National Fire Protection Association. Hasegawa testified that NFPA 921 is well-recognized as the accepted and authoritative guide to fire investigations. NFPA 921 adopts the basic tenets of the scientific method for investigating and determining the cause of a fire or explosion. See Doc. 53, Ex. J, an except from the 2008 Edition of NFPA 921 describing the basic methodology: define the problem, collect and analyze data, develop and test a hypothesis, and select a final hypothesis. Signature contends that Hasegawa did not collect or analyze any data, and did not test his hypothesis.

Hasegawa observed more extensive fire damage to the left

engine than the right engine. He noted that the top of the left engine exhibited significant aluminum melting that was not seen on the right engine. He also stated that more of the right side of the plane remained than the left side. He acknowledged several eyewitness reports of fire and smoke in or near the right engine, but concluded that his own analysis of the available fire evidence indicated that the left engine experienced heat and fire problems, not the right. He believes that "[t]here may have been some confusion from eyewitnesses in regards to orientation."

(Doc. 53, Ex. L) Because the fire developed so quickly, Hasegawa believes it must have been fueled by a highly flammable substance, and oil or aviation fuel are obvious candidates. And he believes that the fracture observed on the left exhaust pipe would provide a "viable ignition source" for an engine fire due to the high temperatures of the exhaust gases. Hasegawa worked on another case involving a Lycoming engine in a Piper Saratoga airplane, and he testified that the airflow patterns in that engine were similar to the engine in this case. He also noted that both Sorenson and Leahy had reported some engine problems, and that one eyewitness heard an engine sputtering just before the crash. All of this supported his opinion that the left engine malfunctioned and experienced a fire.

Signature argues that Hasegawa did not know the distance that separated the oil breather tube from the exhaust pipe, or

how engine oil actually traveled from the engine through the separator tube. He lacked knowledge of the airflow patterns inside the exhaust pipe, and whether the oil/air ratio in the engine compartment that day would have been sufficient to ignite the oil. Signature contends that Hasegawa essentially relied upon Stimpson's flawed assumptions to reach the same flawed opinion. As discussed above, Stimpson's assumptions are not so flawed that Stimpson's opinion is unreliable. And one expert may rely upon the opinions and conclusions reached by other experts, so long as that reliance is reasonable and that the underlying facts and data are of the sort that experts in his field reasonably rely upon. In addition to Stimpson's observations and conclusions, Hasegawa relied on his own observations of the wreckage, specifically differences between the left and right engines, the left and right sides of the airplane in general, and between the left and right exhaust pipes. He considered but discounted the eyewitnesses accounts. He worked in conjunction with Stimpson, who he admits is more knowledgeable about this specific airplane and engine, in reaching his opinion. And as with the other experts, Hasegawa states that the condition of the wreckage precludes any meaningful "scientific" testing.

While this is a closer question than with either Raefsky or Stimpson, the Court cannot conclude that Hasegawa's opinions fall "... outside the range where experts might reasonably differ, and

where the jury must decide among the conflicting views of different experts, even though the evidence is 'shaky.'"

Daubert, 509 U.S. at 596. Hasegawa is qualified in the area of fire science, and the Court concludes that Signature's arguments go to the weight of his opinions and are proper material for vigorous cross-examination.

Signature's Expert Roch Shipley

Plaintiffs seek to exclude Signature's expert, Roch Shipley, from testifying about his opinions. Shipley's report concludes that (1) if there was a pre-crash fire on the airplane, it was on the right side not the left; (2) a likely cause of a right-side fire was the unapproved ferry fuel system lines; (3) the damage observed in the left engine exhaust pipe was created during or after the crash; and (4) even if a hole existed in the exhaust pipe when Leahy took off, the exhaust emitting from that hole would not be sufficient to ignite a fire in the engine compartment. (Doc. 54, Ex. 2)

Shipley and his firm are technical consultants specializing in root cause failure analysis, particularly in matters involving aviation. Shipley has over 20 years of consulting experience, and prior to that worked in aerospace manufacturing research. He is a licensed professional engineer, and has a Ph.D. in metallurgical engineering. He co-edited a standard industry handbook, the tenth edition of the ASM Handbook volume on

"Failure Analysis and Prevention."

Plaintiffs contend that Shipley is not a "fire expert," and should not be permitted to offer opinions on the cause or origin of any engine fire. Shipley acknowledged that Signature's fire expert will offer opinions in that area, and that he does not intend to testify about where any fire may have started. But he was asked about statements in his report in which he discussed the evidence that he believes does not support Stimpson's opinion. In particular, Shipley noted the evidence about the ferry fuel lines and lack of documentation that they had been removed. Plaintiffs attack Shipley's testimony about his observations of the ferry fuel "tee" fitting. Shipley testified that the aluminum fitting cracked and separated in the crash, but that it "looks like there's two different areas on that fracture and that's what suggests to me that there could have been a crack, you know, not completely separated, but a crack causing a leak in-flight." (Shipley Dep. at 18) Plaintiffs argue that Shipley did not perform any metallurgical tests to support this opinion, and since Shipley is a metallurgist, his failure to do so renders his testimony unreliable.

Shipley believes that the damage to the left exhaust pipe was caused by deformation due to an external force, and not due to a "blow out" from within as Plaintiffs' experts have testified. Plaintiffs argue that Shipley did not perform any

metallurgical tests on the pipe before reaching this opinion, and that Raefsky's later testing confirms that Shipley is wrong.

Shipley explained that prior to writing his report, he intentionally refrained from any metallography tests on the pipe in order to avoid destructive testing:

... in my opinion it was more valuable in terms of understanding the condition of the pipe and such to keep it in its original condition. ... So in this case, and as you're well aware, there was extensive discussion about how much destructive testing, how much cutting of the pipe could and should be done. Back in April 2011 it was my opinion that there wouldn't be a lot more information gained, and now the pipe has had material removed from it, so it's more difficult for the jury to visualize what the condition of the pipe was prior to the holes or the pieces being cut out of it.

(Shipley Dep. at 28-29) Shipley participated in the metallurgical tests and examinations conducted under the agreed protocol which Raefsky described, but explained why he felt it was unnecessary to perform the routine metallurgical tests and analyses he was asked about. And Shipley explained his disagreement with Raefsky's conclusions reached after the destructive testing on the exhaust pipe, stating that it was very clear to him "that the internal pressure in this pipe did not blow out the metal. There just isn't enough force. There isn't enough stress to do that."

(Shipley Dep. at 45)

Plaintiffs also seek to exclude Shipley's testimony that even if there was hole in the left exhaust pipe when Leahy took

off from the airport, any exhaust gases coming through that hole could not have started a fire. Plaintiffs contend that this opinion is based upon unsupported assumptions about the size of the inlet and outlet openings in the engine compartment, as well as factors such as air speed, air flow through the compartment, and actual operating temperatures at various points in and around the exhaust pipe.

Signature responds that Plaintiffs' motion and the tenor of the examination at his deposition largely ignore Shipley's field of expertise, materials failure analysis, and the methodology that applies to that field. Instead, Plaintiffs attempt to limit Shipley's expertise to the field of metallurgical engineering, and then argue that his failure to conduct "standard" metallurgical tests renders his opinion unreliable. Plaintiffs accuse Shipley of merely conducting a " cursory" visual examination of the exhaust pipe, an insufficient basis upon which to offer any expert opinions. Signature points out that Shipley spent many hours and took almost 1,700 photographs documenting the condition of the pipe and the crash remains, hardly a cursory inspection. Shipley described his experience in examining artifacts and materials involved in fires, and his knowledge about how such materials respond to fire conditions. Shipley is well qualified in the field of materials and failure analysis, and he applied his knowledge and experience to the information

available along with his own observations of the wreckage to reach his opinions.

Plaintiffs' arguments do not warrant the exclusion of Shipley's testimony, as the Court finds that it is for the trier of fact to weigh Shipley's analyses and explanations in evaluating the strength of his ultimate opinions.

Finally, all four of the challenged witnesses submitted declarations in support of the parties' respective response briefs. An expert may not amend or alter his prior opinions to respond to the opposing party's attacks on the reliability of his opinion. See, e.g., Pluck v. BP Oil Pipeline Co., 640 F.3d 671, 681 (6th Cir. 2011), affirming the district court's exclusion of an expert's supplemental declaration filed after defendant's in limine motion challenging his opinion. The court concluded that the declaration was nothing more than an "attempt to bolster his deficient opinion by employing a new causation methodology." However, an expert may further explain his opinion or, as Shipley and Raefsky contend they have done, provide additional explanations for certain answers to deposition questions that counsel chose not to further explore. An expert may also supplement his opinion and report with additional evidence that may come to light after the initial report.

The Court has reviewed the four declarations and concludes that none of them improperly attempt to change or amend the

experts' basic methodology or their primary opinions.

CONCLUSION

Despite their obvious differences, all of the expert witnesses generally relied on their observations of the remains of the airplane, the available data about the accident, their engineering and technical knowledge, and their training and experience in reaching their opinions. The Court concludes that all four experts satisfy the standards of Rule 702 as articulated in Daubert and its progeny. The motions in limine to exclude the experts and their testimony (Docs. 53 and 54) are therefore denied.

SO ORDERED.

DATED: April 24, 2012

s/Sandra S. Beckwith
Sandra S. Beckwith
Senior United States District Judge